
National Aeronautics and Space Administration
NASA
Launching to the Moon and Beyond
www.nasa.gov
031808

Today's Journey

- What is NASA's mission?
- Why do we explore?
- What is our time line?
- Why the Moon first?
- What will the vehicles look like?
- What progress have we made?
- Who is on our team?
- What are the benefits of space exploration?

What is NASA's Mission?

- Safely fly the Space Shuttle until 2010
- Complete the International Space Station (ISS)
- Develop a balanced program of science, exploration, and aeronautics
- Develop and fly the Orion Crew Exploration Vehicle (CEV)
- Land on the Moon no later than 2020
- Promote international and commercial participation in exploration

"The next steps in returning to the Moon and moving onward to Mars, the near-Earth asteroids, and beyond, are crucial in deciding the course of future space exploration. We must understand that these steps are incremental, cumulative, and incredibly powerful in their ultimate effect."

– NASA Administrator Michael Griffin
October 24, 2006

Why Do We Explore?

- **Inspiration**
  - Inspire students to explore, learn, contribute to our nation's economic competitiveness, and build a better future
- **Innovation**
  - Provide opportunities to develop new technologies, new jobs, and new markets
- **Discovery**
  - Discover new information about ourselves, our world, and how to manage and protect it

NASA's Exploration Roadmap

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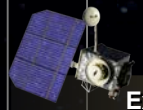


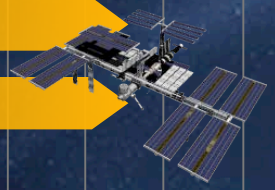
Exploration and Science Lunar Robotics Missions

Lunar Outpost Buildup

Mars Expedition ~2030

Research and Technology Development on ISS

Commercial Orbital Transportation Services for ISS



Space Shuttle Operations

SSP Transition

Ares I and Orion Development

Operations Capability Development
(EVA Systems, Ground Operations, Mission Operations)

Orion and Ares I Production and Operation

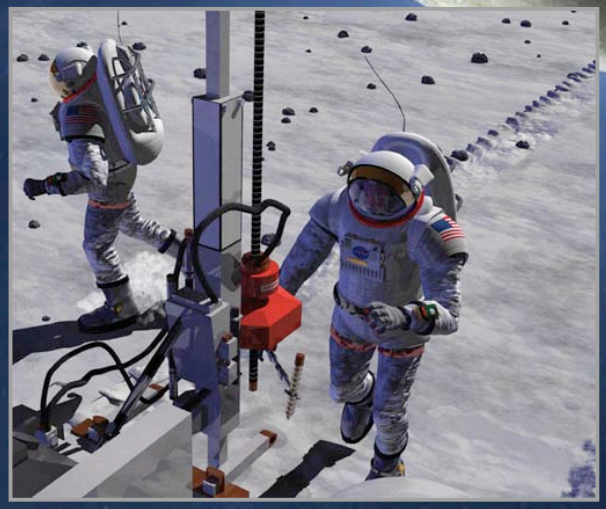
Altair Development

Ares V & Earth Departure Stage

Surface Systems Development

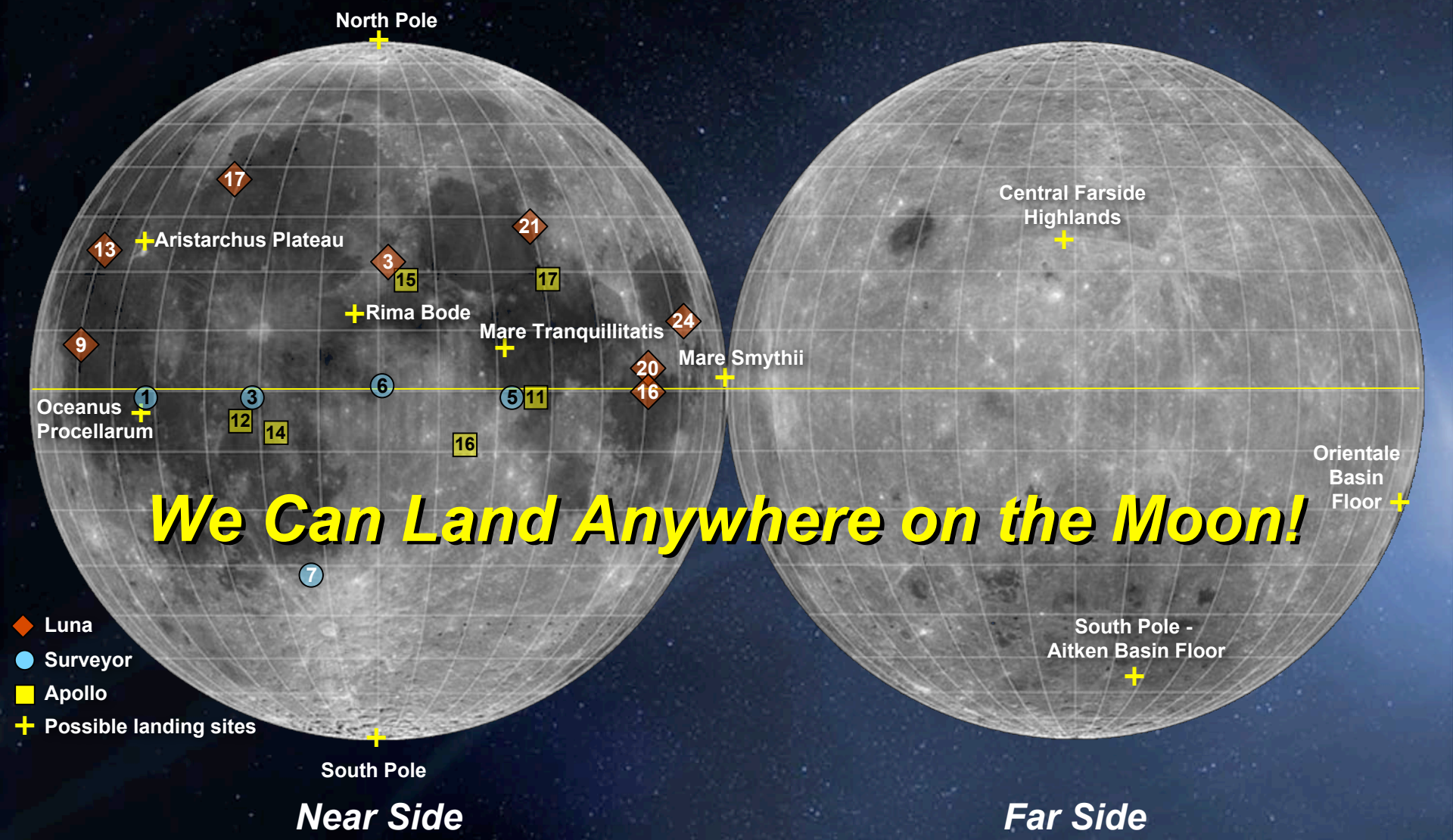
The Moon

- **Lunar missions allow us to:**
  - Gain exploration experience
    - Space no longer a short-term destination
    - Will test human support systems
    - Use Moon to prove ability to build and repair long-duration space assets
  - Develop exploration technologies
    - Launch and exploration vehicles
    - *In-situ* resource utilization
    - Power and robotic systems
  - Conduct fundamental science
    - Astronomy, physics, astrobiology, geology, exobiology



The Next Step in Fulfilling Our Destiny as Explorers

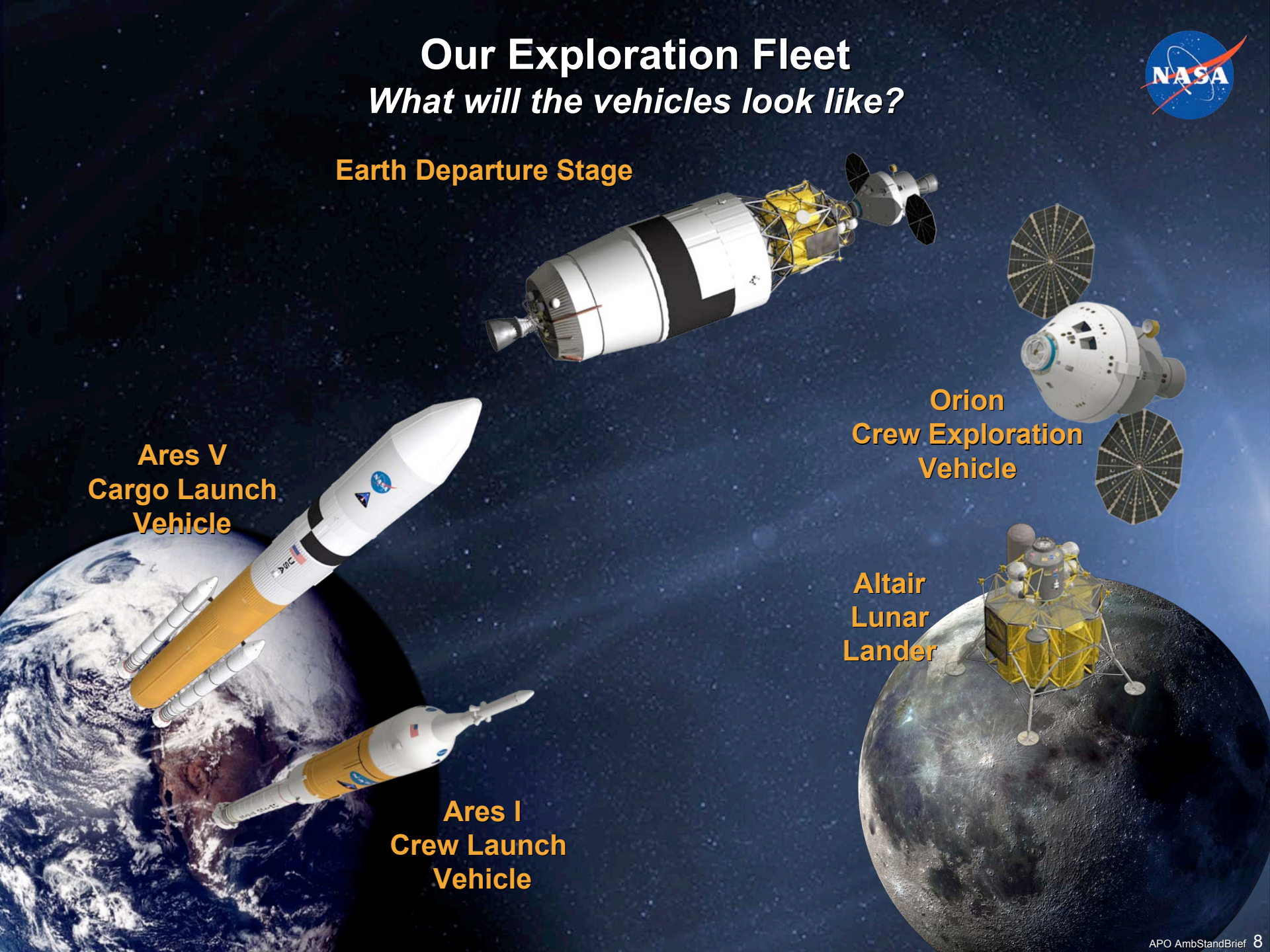
There Are Many Places To Explore



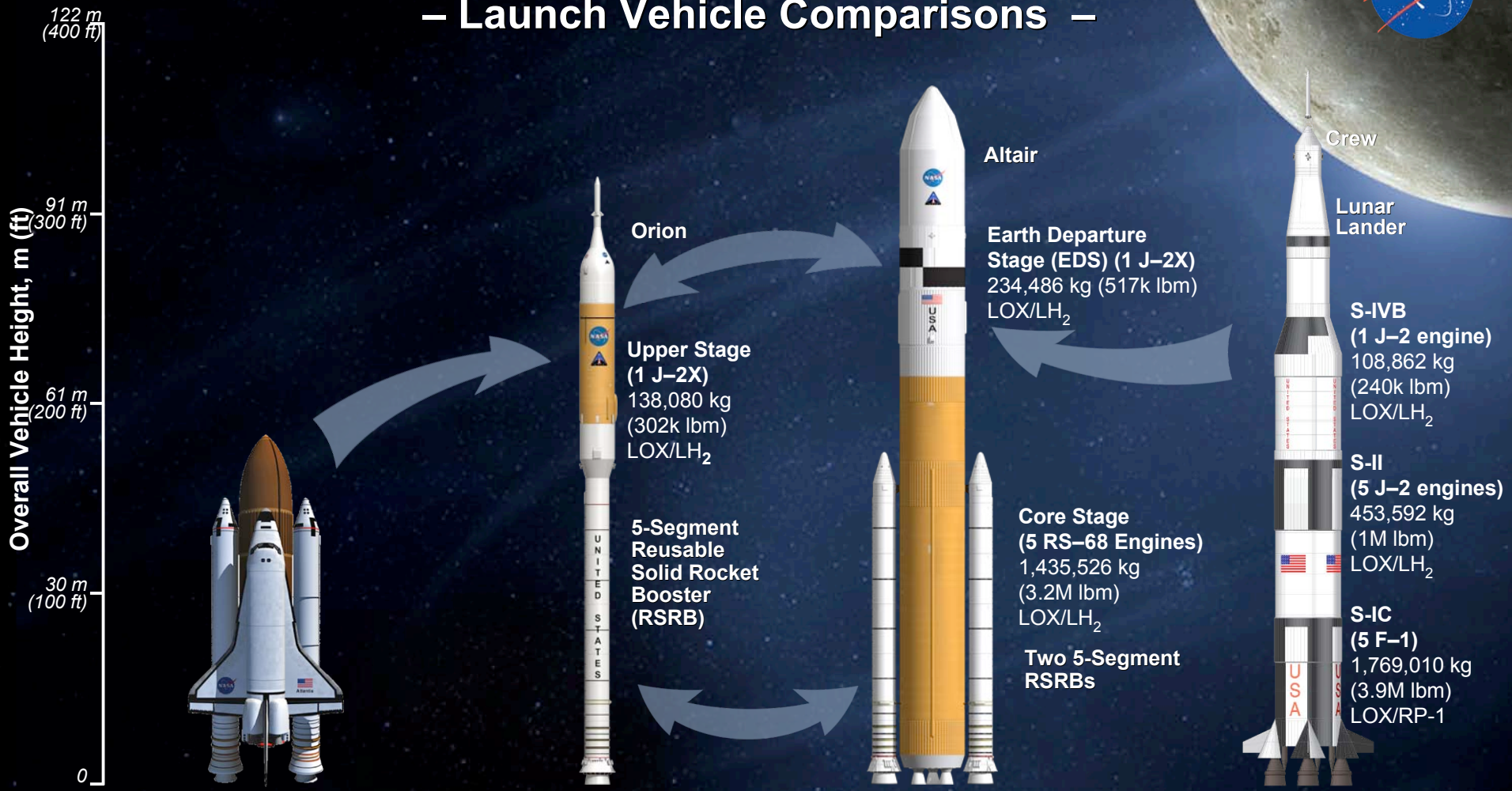
We Can Land Anywhere on the Moon!

Our Exploration Fleet

What will the vehicles look like?



Building on a Foundation of Proven Technologies
– Launch Vehicle Comparisons –



Space Shuttle
Height: 56.1 m (184.2 ft)
Gross Liftoff Mass:
2,041,166 kg (4.5M lbm)

25 MT (55k lbm)
to Low Earth Orbit (LEO)

Ares I
Height: 99.1 m (325 ft)
Gross Liftoff Mass:
927,114 kg (2.0M lbm)

25.6 MT (56.5k lbm)
to LEO

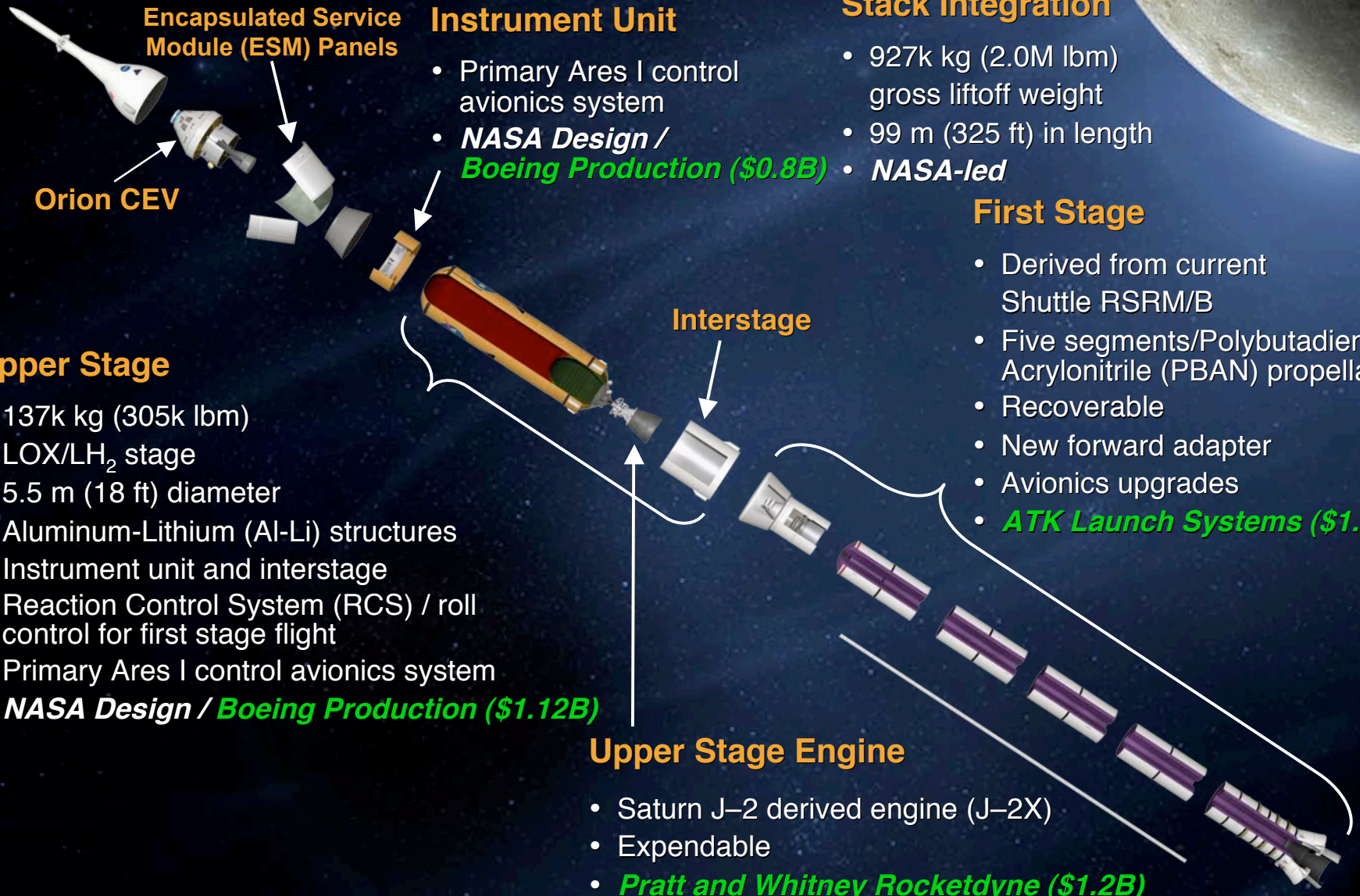
Ares V
Height: 109.7 m (360.5 ft)
Gross Liftoff Mass:
3,374,875 kg (7.4M lbm)

63.6 MT (140.2k lbm) to TLI (with Ares I)
55.9 MT (123k lbm) to Direct TLI
~143.4 MT (316k lbm) to LEO

Saturn V
Height: 110.9 m (364 ft)
Gross Liftoff Mass:
2,948,350 kg (6.5M lbm)

45 MT (99k lbm) to TLI
119 MT (262k lbm) to LEO

Ares I Elements



Instrument Unit

- Primary Ares I control avionics system
- ***NASA Design / Boeing Production ($0.8B)***

Stack Integration

- 927k kg (2.0M lbm) gross liftoff weight
- 99 m (325 ft) in length
- ***NASA-led***

First Stage

- Derived from current Shuttle RSRM/B
- Five segments/Polybutadiene Acrylonitrile (PBAN) propellant
- Recoverable
- New forward adapter
- Avionics upgrades
- ***ATK Launch Systems ($1.8B)***

Upper Stage

- 137k kg (305k lbm) LOX/LH_2 stage
- 5.5 m (18 ft) diameter
- Aluminum-Lithium (Al-Li) structures
- Instrument unit and interstage
- Reaction Control System (RCS) / roll control for first stage flight
- Primary Ares I control avionics system
- ***NASA Design / Boeing Production ($1.12B)***

Upper Stage Engine

- Saturn J–2 derived engine (J–2X)
- Expendable
- ***Pratt and Whitney Rocketdyne ($1.2B)***

Orion Crew Exploration Vehicle

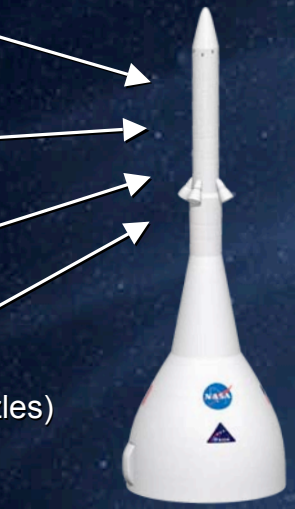
Launch Abort System

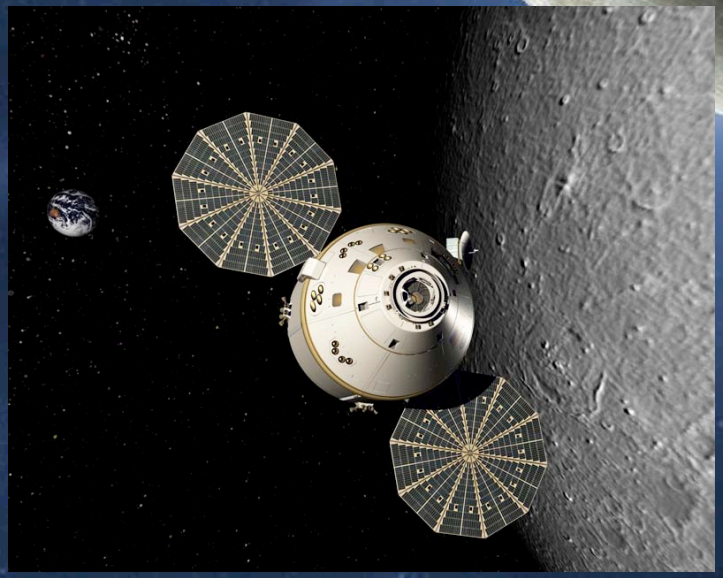
Attitude Control Motor
(Eight Nozzles)

Canard Section
(Stowed Configuration)

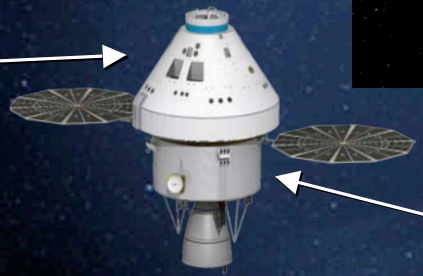
Jettison Motor
(Four Aft, Scarfed Nozzles)

Abort Motor
(Four Exposed, Reverse Flow Nozzles)





Crew Module



Service Module

LOCKHEED MARTIN

Encapsulated Service Module (ESM) Panels

Spacecraft Adapter

Volume: 10.8 m^3 (380 ft^3)
- 80% larger than Apollo

Diameter: 50 m (16.5 ft)

Ares V Elements

Stack Integration

- 3.4M kg (7.4M lbm) gross liftoff weight
- 110 m (360 ft) in length

First Stage

- Two recoverable 5-segment PBAN-fueled boosters (derived from current Ares I first stage)

Earth Departure Stage (EDS)

- One Saturn-derived J–2X LOX/LH_2 engine (expendable)
- 10 m (33 ft) diameter stage
- Aluminum-Lithium (Al-Li) tanks
- Composite structures, instrument unit and interstage
- Primary Ares V avionics system

Core Stage

- Five Delta IV-derived RS–68 LOX/LH_2 engines (expendable)
- 10 m (33 ft) diameter stage
- Composite structures

Vehicle 51.0.34

Journey to the Moon

What Progress Have We Made?

- **Programmatic Milestones**
  - Completed Ares I System Requirements Reviews
  - Contracts awarded for building the first stage, J–2X engine, upper stage, instrument unit, and Orion
  - Completed Ares I System Definition Review
  - Ares I–X test flight scheduled for April 2009
- **Technical Accomplishments**
  - Testing first stage parachutes and developing nozzles
  - Constructing new J–2X test stand at Stennis Space Center
  - Performing J–2X injector tests and power pack tests
  - Fabricating Ares I–X hardware
  - Testing in wind tunnels

Nozzle Process Simulation Article

Powerpack 1A Testing

Dome Gore Panel Fabrication

"Roughing" of 1% Model

For more information go to www.nasa.gov/ares

Ares I–X Test Flight

- **Demonstrate and collect key data to inform the Ares I design:**
  - Vehicle integration, assembly, and launch operations
  - Staging/separation
  - Roll and overall vehicle control
  - Aerodynamics and vehicle loads
  - First stage entry dynamics for recovery

- **Performance Data:**

	Ares I–X	Ares I
First Stage Max. Thrust (vacuum):	14.1M N (3.13M lbf)	15.8M N (3.5M lbf)
Max. Speed:	Mach 4.7	Mach 5.84
Staging Altitude:	39,624 m (130,000 ft)	57,453 m (188,493 ft)
Liftoff Weight:	834k kg (1.8M lbm)	927k kg (2.0M lbm)
Length:	99.1 m (327 ft)	99 m (325 ft)
Max. Acceleration:	2.46 g	3.79 g

Ares Nationwide Team

ATK Launch Systems

Marshall

Glenn

Ames

Langley

Pratt & Whitney Rocketdyne

Kennedy

Johnson

Michoud Assembly Facility

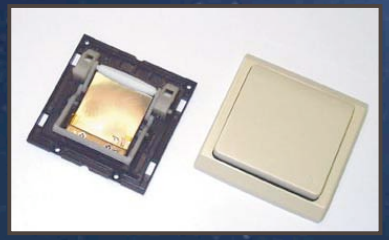
Stennis

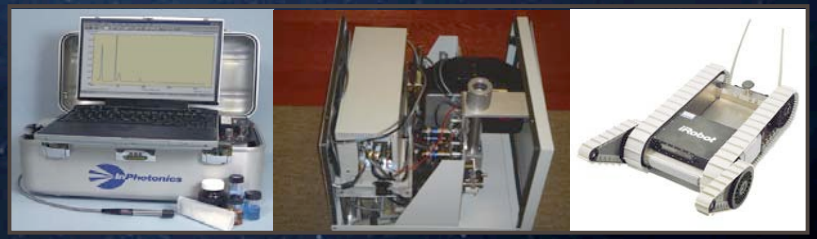
Boeing

Down-to-Earth Benefits from the Space Economy

NASA powers innovation that creates new jobs, new markets, and new technologies.

- **Personal Health**
  - Eye tracker for LASIK surgery
  - Breast biopsy system
- **Consumer Products**
  - Wireless light switch
  - Remote appliance programmer
  - Global Positioning Systems (GPSs)
- **Environmental**
  - Water Filtration system
  - Environmentally friendly chemical cleanup
- **Security**
  - Stair-climbing tactical robot
  - Crime scene video enhancement





For more information see http://technology.jsc.nasa.gov

Every Dollar Invested in Space is Spent on Earth.

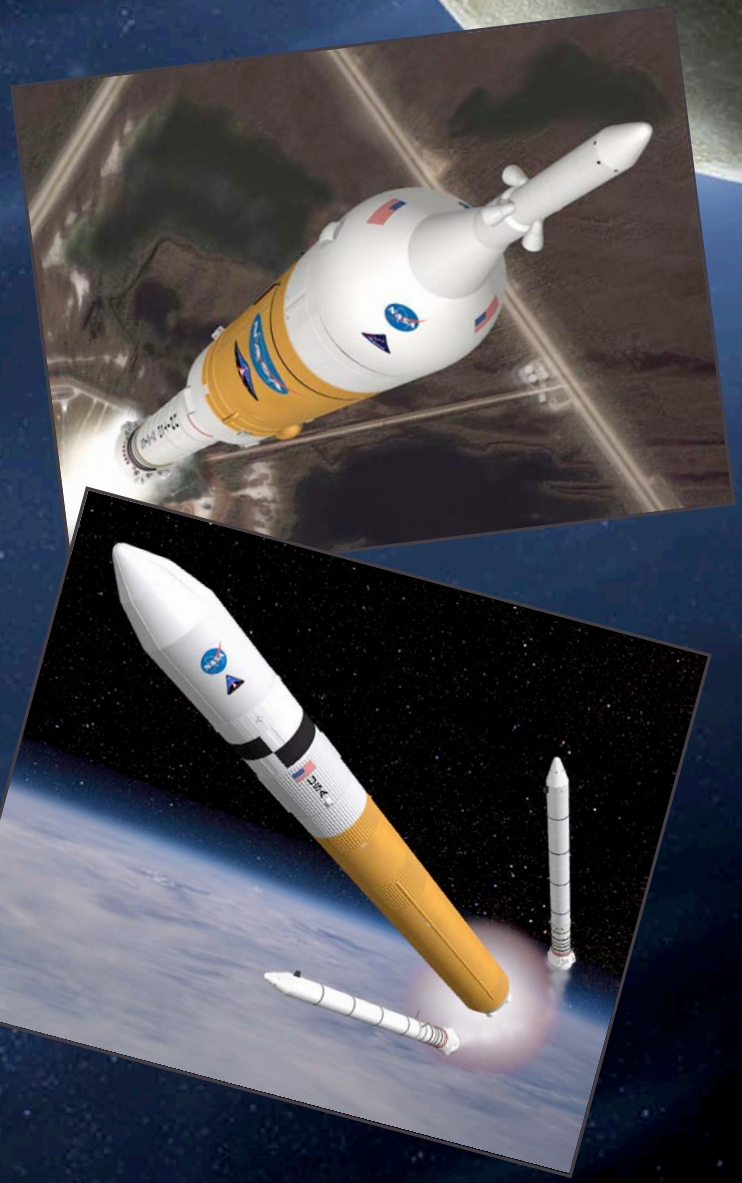
NASA Explores for Answers that Power Our Future

NASA powers inspiration that encourages future generations to explore, learn, and build a better future.

- **NASA relies on a well-educated U.S. workforce to carry out missions of scientific discovery that improve life on Earth.**
- **America's technological edge is diminishing.**
  - Fewer engineering graduates from U.S. colleges and universities
  - More engineering and science graduates in other countries
- **The global marketplace is increasingly competitive and technology-driven.**
- **Students need motivating goals and teachers with information to share.**
- **NASA continues to develop educational tools and experiences that inspire, educate, and motivate.**

Summary

- Human beings will explore the Moon, Mars, and beyond to encourage inspiration, innovation, and discovery.
- We must build beyond our current capability to ferry astronauts and cargo to low Earth orbit.
- We are starting to design and build new vehicles, using extensive lessons learned to minimize cost, technical, and schedule risks.
- Exploring the Moon will help us reach Mars and beyond.
- Team is onboard and making good progress—the Ares I–X test flight is on schedule for April 2009.



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